

Key

Exam #4 Review Chapters 11 and 13

1) As a solid element melts, the atoms become more separated and they have less attraction for one another. $S \rightarrow L$

- A) more separated, more
C) closer together, more

- B) more separated, less**
D) closer together, less

E) larger, greater

2) Which one of the following exhibits dipole-dipole attraction between molecules?

A) XeF₄

B) AsH₃

C) CO₂

D) BCl₃

E) Cl₂

3) Of the following substances, only _____ has London dispersion forces as its only intermolecular force.

A) H₂O *polar, molecule*

B) CCl₄

C) HF

D) CH₃COOH

E) PH₃

4) Which one of the following should have the lowest boiling point?

A) PH₃

B) H₂S

C) HCl

D) SiH₄

E) H₂O

5) Of the following substances, _____ has the highest boiling point.

A) CH₃CH₂OH

B) C₂H₆

C) N₂

D) F₂

E) HOCH₂CH₂OH

6) Which one of the following derivatives of ethane has the highest boiling point?

A) C₂Br₆

B) C₂F₆

C) C₂I₆

D) C₂Cl₆

E) C₂H₆

7) What types of intermolecular forces exist between HI and H₂S?

A) dipole-dipole and ion-dipole

B) dispersion forces, dipole-dipole, and ion-dipole

C) dispersion forces, hydrogen bonding, dipole-dipole, and ion-dipole

D) dispersion forces and dipole-dipole

E) dispersion forces, dipole-dipole, and ion-dipole

8) Based on the following information, which compound has the strongest intermolecular forces?

Substance

ΔH_{vap} (kJ/mol)

Argon (Ar)

6.3

Benzene (C₆H₆)

31.0

Ethanol (C₂H₅OH)

39.3

Water (H₂O)

40.8

Methane (CH₄)

9.2

A) Argon B) Benzene C) Ethanol **D) Water** E) Methane

9) Of the following, _____ is the least volatile. *highest b.p. $\therefore$ strongest IMF*

A) CBr₄

B) CCl₄

C) CF₄

D) CH₄

E) C₆H₁₄

largest
 $M \approx 331.6 \text{ g/mol}$

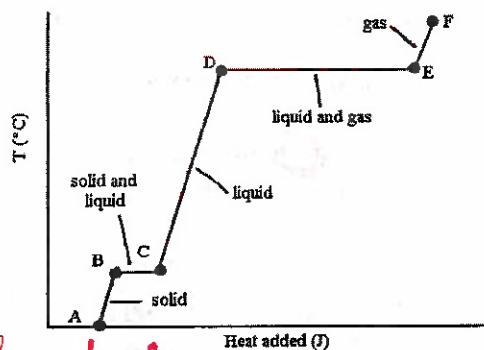
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$M \approx 16$

$M \approx 86 \text{ g/mol}$

$\text{Disp.} \Rightarrow \uparrow M, \uparrow \text{b.p.}$

Key



10) The phase changes B $\rightarrow$ C and D $\rightarrow$ E are not associated with temperature increases because the heat energy is used up to _____.

- A) increase distances between molecules (inter) B) break ~~inter~~ molecular bonds
 C) rearrange atoms ~~within~~ molecules ~~btwn~~ atoms D) increase the velocity of molecules
 E) increase the density of the sample

$\rightarrow$ intensive property $\therefore$ doesn't change

$\rightarrow$ this would change T b/c speed

11) The dissolution of water in octane (C_8H_{18}) is prevented by _____.

- A) London dispersion forces between octane molecules (weak)
 B) hydrogen bonding between water molecules
 C) dipole-dipole attraction between octane molecules
 D) ion-dipole attraction between water and octane molecules
 E) repulsion between like-charged water and octane molecules

$\rightarrow$ polar $\Rightarrow$ H-bond = major

H-bonds are stronger than dispersion so the E required to break them is more than the E gain of forming $H_2O \cdots octane$ in a sol'n $\uparrow$ dispersion IMF

12) The principal reason for the extremely low solubility of NaCl in benzene (C_6H_6) is the _____.

- A) strong solvent-solvent interactions B) hydrogen bonding in C_6H_6
 C) strength of the covalent bond in NaCl D) weak solvation of Na^+ and Cl^- by C_6H_6
 E) increased disorder due to mixing of solute and solvent

$\rightarrow$ only in NaCl (solute)

solvent ionic bond non-polar, dispersion

$\rightarrow$ this would help solubility not alike IMF $\therefore$ not soluble

13) Which one of the following substances would be the most soluble in CCl_4 ? Least soluble?

- A) CH_3CH_2OH H-bonding
 B) H_2O H-bonding
 C) NH_3 H-bonding
 D) $C_{10}H_{22}$ dispersion
 E) NaCl ionic bonding

- A) CH_3CH_2OH polar
 B) H_2O polar
 C) NH_3 polar
 D) $C_{10}H_{22}$ nonpolar $\Rightarrow$ disp.
 E) NaCl ionic bonds

non-polar dispersion $\rightarrow$ polar or ionic bonds most different

14) Which one of the following is most soluble in water? polar, H-bonding

- largest $\rightarrow$ fraction of the molecule w/ similar IMFs
 A) CH_3OH B) $CH_3CH_2CH_2OH$ C) CH_3CH_2OH
 D) $CH_3CH_2CH_2CH_2OH$ E) $CH_3CH_2CH_2CH_2CH_2OH$

15) Which of the following choices has the compounds correctly arranged in order of increasing solubility in water? (least soluble to most soluble)

- A) $CCl_4 < CHCl_3 < NaNO_3$
 B) $CH_4 < NaNO_3 < CHCl_3$
 C) $CH_4 < NaNO_3 < CHCl_3$
 D) $LiF < NaNO_3 < CHCl_3$
 E) $CH_3OH < Cl_4 < CHCl_3$

- B) $CH_3OH < CH_4 < LiF$
 C) $CH_4 < NaNO_3 < CHCl_3$
 D) $LiF < NaNO_3 < CHCl_3$
 E) $CH_3OH < Cl_4 < CHCl_3$

most similar H-bonding or ion-dipole stronger so would want ionic compound